THE TREATMENT OF LARYNGEAL TUBERCULOSIS IN SANATORIA*

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FROM the literature one is forced to conclude that outside the larger health resorts and occasional sanatoria, the treatment of laryngeal tuberculosis has not been energetic. Yet, the literature shows that much may be done for such cases. Specialists are, perhaps, quite properly critical of amateurs entering their field. Those sanatoria, however, which are isolated and which cannot have the convenience of consultations and regular visits from specialists must, perforce, undertake the treatment of laryngeal tuberculosis by members of the staff; even operative procedures, if these cases are to get their due. With reasonable restriction in regard to the hopeless, this group of cases should be admitted to sanatoria where they can best be treated, since frequent visits to an office may be prejudicial to their recovery.

In 1922, through a *questionnaire* sent to twenty sanatoria in Canada, I made an enquiry regarding the amount of laryngeal tuberculosis recognized, and the routine of examination and treatment employed. Of 8,393 cases, 5.4 per cent actually had tuberculous laryngitis. Since the number of patients in the different institutions varied greatly, the average of the percentages of each institution probably gives a truer estimate of its prevalence; this was 8.6 per cent. In thirteen sanatoria discrimination against the admission of cases with tuberculous laryngitis was probably exercised; these averaged only 4.5 per cent, while in six institutions in which there was no selection, the average was 16.6 per cent. It was striking that in two adjoining provinces with large provincial institutions, in one the average was 33 per cent, and in the other 3.2 per cent.

Besides discrimination against the cases with laryngeal tuberculosis no doubt the general class of patient admitted varied, as did the criteria of diagnosis and the thoroughness of routine examination. Because of these last two variables, 8.6 per cent is probably too low. In four institutions in Massachusetts, Hawes found the incidence of laryngeal tuberculosis to be 8 per cent. At Mount Vernon Sanatorium, Barwell found 11 per cent; at the King Edward Sanatorium, Sir St. Clair Thomson 22.2 per cent; and at Otisville Sanatorium, Dworetsky 25.6 per cent. At the large tuberculosis clinic of the Gage Institute, Toronto, only 1.2 per cent of the patients examined by laryngologists had laryngeal tuberculosis, while at the Henry Phipps Institute in Philadelphia, 7.4 per cent showed laryngeal tuberculosis. Probably admissions to the hospital of the Phipps Institute, also went through the clinic.

In the twenty Canadian sanatoria, examination of the larynx on admission and as a routine was undertaken in eight; on admission and suspicion in six; on admission only in two; and on suspicion only in four. A consulting laryngologist visited at regular intervals of from one week to two months, in four, and at irregular intervals in six. In ten there was no consulting laryngologist on the staff. Adequate facilities for treatment were found in one; incomplete facilities in four; and nine depended upon a local specialist.

In regard to treatment, silence, whispering, sprays and insufflations were used in all; intratracheal injections in six; pigments in eleven; chaulmoogra oil in two; natural heliotheraphy in twelve; artificial in two; tuberculin in five; nerve blocking in seven; the galvano-cautery in two; curettage in one; epiglottidectomy in four; other operations in three.

In 2,857 cases of phthisis, recorded by four authors, quoted by Lockard, the average of laryngeal involvement was 29 per cent. Horne in 359 consecutive cases of phthisis found no change in the larynx in only nine, although he considered fifty-five would escape the naked eye at post-mortem, *i.e.*, in 97.5 per cent, the larynx was tuberculous. Fetterolf found 83 per cent of cases coming to autopsy at the Henry Phipps Institute had the larynx involved. At Bromp-

* Read at a meeting of the Ontario Laennec Society, May 25, 1926.

ton Hospital 52.6 per cent showed naked eye evidence of tuberculosis at post-mortem. By microscopical section even higher percentages than these have been shown to be tuberculous.

St. Clair Thomson's comparison of the mortality in sanatorium patients without and with laryngeal tuberculosis from three to seven years after discharge, emphasizes the importance of this complication in prognosis. In contrasted groups laryngeal tuberculosis makes the prognosis relatively more gloomy for the earlier pulmonary cases than the moderately advanced, and more so for these than for the far advanced. Without this complication the expectation in fairly early cases is that 60 per cent of patients will be alive in from three to seven years after discharge from the sanatorium. In similar groups of pulmonary cases, this complication reduces those living to 30 per cent. For prognosis, a laryngeal examination may outweigh in importance all other clinical examinations. While not necessarily the fatal disease of a generation ago, he considers laryngeal tuberculosis, next to meningitis, the most serious complication of pulmonary tuberculosis.

During the period 1909–1922*, of 652 tuberculous patients treated in two small sanatoria, 107 (16.4 per cent) had laryngeal tuberculosis. Laryngitis considered to be non-tuberculous occurred in 9.5 per cent. The following tables briefly summarize points of interest in a complex analysis:

*The material upon which this paper has been based was analyzed in 1922, and, while it has been used for several addresses, it has not hitherto been published except in the Transactions of the American Climatological and Clinical Association for 1923.

CLASSIFICATION NATIONAL TUBERCULOSIS ASSOCIATION

Type-general	*Whole series* %	*Group Tub. Laryn.* %
Incipient	28	0
Mod. Adv	22	24
Far Adv	50	76
Result-general		
Arrested	5	0
Ap. arrested	14	3
Quiescent	20	8
Improved	41	44
Unimproved	17	38
Died	3	7
Result of Treatment Laryngeal Lesion		
	%	%
Ap. cured	6	26
Arrested	1	
Ap. arrested	19	
Quiescent	7	27
Improved	20	
Stationary	25	25
Unimproved	17	22
Died	5	

For more than twenty years I have been so placed that regular visits by specialists were quite impracticable, and I have been obliged to attempt the treatment of these cases myself.

CLASSIFICATION OF MAJOR LARYNGEAL LESION

Type	%	*Character* — *Congestion*	*Infiltration*	*Ulceration*	*Hypertrophy*
Mild	56	7	17	17	15
Moderate	25		7	18	
Severe	15			14	1
Healed	4				
		7	24	49	16

ANALYSIS OF LESIONS

362 lesions (358 intra laryngeal) recorded in 114 cases (7 twice included).

Site	*Total Percentage*	*Character* — *Congestion*	*Infiltration*	*Ulceration*	*Hypertrophy*	*Paresis*	*Fixation*
Epiglottis	6.7	1.7	2.5	2.5			
Ary.-epiglottic folds	2.0	.3	1.7				
Ventricular bands	12.5	3.4	5.8	3.0	.3		
Vocal cords	34.4	13.6	7.0	10.0	1.9	2.8	
Arytenoids	11.3	3.1	3.9	3.4	.8		.3
Inter-ary. space	25.9	3.4	10.8	5.8	5.8		
Ant. commissure	.3			.3			
Subglottic	5.6	.5	4.5	.5			
Percentage total	100	25.9	36.2	25.9	8.9	2.8	.3

The pharynx was involved in one case (.3%) and glands in three cases (.9%).

Methods of Treatment (exclusive of voice rest and sprays, used in the great majority):

Intratracheal injections in 1 (+), pigments in 21 (+), reflected sunlight in 3, galvano-cautery in 17, operations in 9—(curetting 4, arytenoidectomy 1, epiglottidectomy 4, tracheotomy 1), and nerve blocking in 4 cases. As an auxilliary tuberculin was used in 18, and artificial pneumothorax in 14 cases.

Records for the first seven years are lost to me. During this period pigments, especially formalin, with occasional curettments, were consistently used, with fair results, effecting cures in a number of cases and restraining progress of the lesion in many others. Except in very mild cases I have never felt it right to rely upon sanatorium treatment alone, when it seemed possible to accomplish something by local treatment.

The daily application of pigments is very exacting in the matter of time. This is well illustrated in Bulloch's large series, which, however, show what remarkable results can be obtained by such persistent treatment. During the last fourteen years, however, I have used the galvano-cautery consistently where applicable, and this, with voice-rest, has made it possible to dispense almost entirely with other time-consuming measures. It has, as Wood expresses it, "largely displaced bloody surgery," and the results are frequently quite dramatic. It is a practicable and relatively easy method of treatment, although its adoption has been slow. It was, I believe, first used for laryngeal tuberculosis by Voltolini in 1861, and again by Heryng about 1887. Dundas Grant advocated it at the beginning of this century, but it was little used until Mermod's and Gruenwald's publications in 1903 and 1907 respectively. As early as 1904 Harland used it at the Henry Phipps Institute. Thomson found that while sanatorium treatment with silence arrested the local lesion in 12.5 per cent of his whole series, the galvano-cautery added 8.5 per cent to the arrested group. He applied it to 20 per cent of the whole series and secured arrest in 42 per cent of the cases thus treated. Its adoption should be general in all sanatoria. Of seventeen cases of my series its use was only intended to be palliative in three; these patients died. In two the condition remained stationary; in two there was material improvement; and in ten (59 per cent of the cases thus treated) the result was either apparent cure or arrest of the lesion. It has been used in a number of other cases not included in this series. The appended case histories will illustrate its value as the major factor in promoting recovery from the laryngeal complications.

In the sanatorium the patient with laryngeal tuberculosis has living conditions and a régime under which local measures give much more promise of benefit than when they are carried out without these advantages. Atmospheric conditions are improved and the irritation of tobacco and alcohol controlled. Rest of voice, even silence, can be carried out with daily encouragement and with the maintenance of some companionship. The conditions above the larynx which further laryngeal irritation emphasized by all writers, can be investigated, referred if necessary to a rhinologist, and treated as a matter of routine. Such treatment may lessen irritation and cough surprisingly. Cough may, even more than talking, aggravate the lesion. Its cause should be carefully sought. Liquifying expectorants and sedatives are usually necessary for a time. Cleansing and sedative sprays, and sedative intratracheal injections and insufflations can be undertaken at frequent intervals as a routine and given effectively. Instruction and supervision in the use of reflected sunlight are easily managed. This last method of treatment has greatly reduced apprehension in regard to definite or suspected laryngeal tuberculosis in our western provinces, where it can be promptly and efficiently applied.

More active measures will be frequently indicated. While procrastination in their application will sometimes be desirable, prompt active interference may gain greater security for the patient and save him much time and apprehension, and also save both the physician and staff much time. The swabbing with pigments while condemned by some, has given marked success to others who have patiently followed this method. I am convinced of their value but now seldom use them. Frequent applications of formalin and lactic acid have been displaced by the occasional use of Lake's pigment or by the galvano-cautery (lactic acid 50, formalin 7, carbolic acid 10, water 33). Such pigments are best applied with a curved applicator of tapered brass wire, which is flexible, yet springy, and is less likely to do injury than are the rigid applicators usually listed by the instrument makers. After a moderate amount of practice by the sanatorium physician on an improvised dummy, the consistent application of formalin (3–10 per cent), lactic acid, or iodoglycerine solution will in localized ulcerations have some beneficial effect, at least in lessening secondary infections, and at the same time be excellent training for endo-laryngeal operations. Then, the occasional application of Heryng's curettes, while useful in itself by removing infected tissue, will help to make applications of pigments more effective.

These curettes are also of use in the removal of granulomata and tuberculomata. Here the

double curettes or punch forceps of Lake or Barwell or Watson Williams are more effective. The epiglottis punch-forceps of Lake used with or without the fixation forceps of Hett, can remove the epiglottis with one punch and give the greatest relief to odynophagia when due to a diseased epiglottis. Escat's tongue retractor is a help for this relatively simple operation. After such removal pain may remain because of a swollen arytenoid, which may also be relieved by the removal of a portion of it with Lake's forceps or preferably by igripuncture. The latter method is also urged by Wood as superior to and safer than epiglottidectomy. Indeed, the galvanocautery has fairly displaced all operative measures, possibly excepting that of epiglottidectomy and that for the preliminary removal of papillomata with bases of limited extent.

The electric cautery is not difficult to use when reasonable dexterity in making topical applications has been acquired. The point can be placed while cold but must be removed while hot. On removal there is the easy possibility of scorching the opposite laryngeal surface by the heel of the cautery. Dan McKenzie has designed a set of five points set at different angles, which I have been accustomed to use, with a most convenient handle designed by Hovell. Wood describes three types of points with which I am unfamiliar.

For endo-laryngeal operations an hour is chosen as far as possible from a meal. An injection of morphia gr. 1/6 and atropin gr. 1/150 is given twenty minutes before anæsthetization is begun. This greatly lessens the secretions of mucus later, besides being sedative to the patient in every way. The pharynx is lightly sprayed with 1 per cent cocaine solution. Ten drops of 10 per cent cocaine solution is measured into a small conical glass to which a drop or two of adrenalin solution is added. Two drops are dropped upon the papillæ at the base of the tongue, also upon the epiglottis, and into the larynx while the patient phonates. The remainder, two drops at a time, is placed upon the site of cauterization at intervals of two minutes. A Hartwell's dropper is most convenient. The patient is required to expectorate the solution promptly. A part of a measured grain of cocaine crystals is then applied on a moistened swab directly to the site to be cauterized and held there as recommended by Wood; this is repeated in three minutes and after another three minutes cauterization or operation is begun. Experiments may show that less cocainization will suffice. After the operation, oil sprays, or intratracheal injections of a sedative oil solution, and the throat ice-bag give comfort.

The object of this method of treatment is not merely the destruction of a certain amount of tuberculous tissue but the production of a reaction, resulting in improved blood supply and the formation of scar tissue. The disappearance of tubercle in the cauterized and surrounding tissues has been shown experimentally by Wood. The patient must have enough vitality to react sufficiently to repair the injury done by the cautery. With such reactive power there is no contraindication to cauterization as regards the pulmonary lesion and general conditions. The first cauterization should be cautiously undertaken, and should be limited when the general condition is much impaired. At all times restraint should be exercised in regard to the number of punctures and amount of surface attacked. The depth of puncture must be controlled in order to avoid burning cartilage. It is best to do rather less than one may feel inclined to do. Experience only can teach the extent and depth of cauterization for different types of lesions and patients. The same area should not be again attacked until healing has taken place and opportunity for shrinkage given. This will require about a month. Other areas may, meanwhile, be treated. The reaction is relatively slight. Only once have I seen distress from dyspnœa, when cauterization was combined with a cutting operation in a small larynx. The patient rarely suffers pain at the time and is not fearful of a repetition of the treatment. Soreness afterwards subsides quickly and is seldom severe. Wood believes that all types of localized tuberculous lesions within reach will be more successfully combated by cauterization than by any other form of treatment and that 90 per cent of incipient cases can be cured.

Active treatment is to be preferred, as a rule, to delay when the lesion is early, even though the lung disease is probably curable. Active treatment is necessary in grave cases for the relief of pain and sometimes for dyspnœa. Then extreme weakness is the only contraindication. When there are no severe symptoms in acute and far advanced cases, operative treatment is unnecessary and probably prejudicial. As a rule, the higher the disease is situated in the larynx the more urgent is the need for energetic treatment, because of the likelihood of rapid extensive infiltration.

For palliative treatment, Leduc's autoinsufflator for anæsthetic and antiseptic powders, Yankauer's dropper for solutions, and Seymour Jones' U-auto-injector for intratracheal injections of solutions in oil are most useful. The last mentioned is used by inserting a catheter through a nostril, the point of which behind the uvula immediately overhangs the larynx. Nerve blocking has given relief, sometimes very marked, in about 60 per cent of the attempts. It has been repeated a number of times on the same patient. Epiglottidectomy may also be necessary even with successful nerve blocking, to give full relief. Feeding, and posture when taking food, demand much consideration.

In the sanatorium, laryngeal tuberculosis has not proved fatal in cases, which otherwise had a favourable prognosis. It has been the least dangerous complication of pulmonary tuberculosis and the one most amenable to treatment. It has often become arrested or cured before the patient had recovered from the pulmonary disease. Even in cases entering with advanced laryngeal lesions and bad prognosis, relative comfort can frequently be given by active measures. To be able to change certain disaster to relative or complete recovery by a little skilful interference is such a satisfaction that the treatment of laryngeal tuberculosis in sanatoria deserves every consideration.

CASE HISTORIES

C. 36. Mrs. B. T. P. Age thirty-eight. Admitted February 24, 1918. Discharged June 4, 1920. Duration of disease fourteen years. Variable laryngeal symptoms during this time. Present illness began eight months before admission. Symptoms general; also hoarseness, almost complete aphonia. Far advanced; slight lesion right lung; moderate in left with cavity.

Larynx.—Hoarseness, lancinating pains in right ear and odynophagia; moderate papilloma, ulceration at apex on left side of interarytenoid sulcus. March 24th, papilloma cauterized. April 30th, cauterized. May 1st, healthy granulations; throat has not been so comfortable in years. Six months after first application only small elevated scar was to be seen. When seen three years later, no recurrence of laryngeal trouble, despite the fact that there had been a gradual enlargement of the cavity in the left lung, and an attempted pneumothorax had been unsuccessful. While patient had made great improvement in weight, symptoms of pulmonary activity were induced by the slightest liberty of movement; she continued to remain on most complete rest. Early in 1926 the patient was reported living but details in regard to her condition were unknown.

M. 58. Mr. H. P. B. Age thirty-one. Admitted May 17, 1915. Discharged April 2, 1917. Pleurisy with effusion in 1903. Recent breakdown in December, 1914. January, 1915, throat sore; odynophagia, huskiness; recent hæmoptysis; constitutional symptoms marked. Far advanced; right lung moderate lesion; left lung severe lesion.

Larynx.—Right cord thickened, large granuloma at middle. Infiltration of left arytenoid. Slight ulceration in interarytenoid space. June 1, 1915, galvano-cauterization right cord and left arytenoid. June 24th, both ventricular bands swollen. July 3rd, cauterization of left ventricular band and left arytenoid. August 15th, cauterization of left arytenoid; application of Lake's solution to the ulcer, which was followed by severe reaction. September 15th, throat improved; relative fixation of left cord. December 14th, superficial ulceration of the right cord and moderate congestion. Left ventricular band thickened, probably ulcerated, left cord irregularly thickened and congested. Less soreness in larynx. March 18, 1916, cauterization of left ventricular band and recently infiltrated right arytenoid. March 22nd, cauterization of interarytenoid space. May 18th, cauterization of interarytenoid space. October 24th, a small papilla in the centre of the interarytenoid space. Slight fissure in the right ventricular band; the left cord fixed, not congested, overshadowed by the left ventricular band; scar on the left arytenoid. February 24, 1917, mucous membrane of very normal appearance. Left cord fixed, but few sensations referred to the larynx. Patient has used voice for three months—fair quality when not strained. Marked general and pulmonary improvement. May 29, 1926, the patient has been carrying on his occupation as salesman since discharge, for the nine years; uses voice a great deal; no recurrence of laryngeal lesion; has this year had further invasion of the left lung and has developed a cold abscess at the right costal margin, but is still working.

Intracutaneous Salt Solution Test.—The use of the intracutaneous salt solution test as a test of the efficiency of the circulation in the extremities is discussed by Milton B. Cohen, H. S. Appelbaum and E. L. Hainsworth, Cleveland. It is said to be a rapid and accurate method of determining tissue affinity for water. Sixty minutes or more is the normal disappearance time. In all conditions associated with localized anoxemia, the salt solution disappearance time is decreased. In cardiac disease with decompensation, the disappearance time is always twenty minutes or less in the edematous areas. If there is no decompensation, normal values are obtained. In cases with peripheral arterial disease, the disappearance time is always decreased in areas showing clinical involvement. From observations in thirty-five cases, it has been noticed that readings below ten minutes have been found only in tissues immediately above areas of gangrene. Readings between ten and twenty-five minutes are strongly suggestive of developing gangrene.—*Jour. Am. Med. Ass.*, May 29, 1926.